NINTH ANNUAL REPORT

OF

Rutgers Scientific School;

THE STATE COLLEGE,

FOR THE BENEFIT OF

AGRICULTURE AND MECHANIC ARTS,

FOR THE YEAR 1873.

TRENTON, N. J.:
THE STATE GAZETTE—MURPHY & BECHTEL, BOOK AND JOB PRINTERS.
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REPORT OF THE TRUSTEES.

To His Excellency Joel Parker, Governor of the State of New Jersey :

SIR:—I beg leave, in behalf of the Trustees of Rutgers College, to submit the ninth annual report of Rutgers Scientific School, in accordance with the requirements of the act of Congress, approved July 2, 1862, and of the act of the Legislature of the State of New Jersey, approved April 4, 1864.

I. FACULTY OF RUTGERS SCIENTIFIC SCHOOL.

The Faculty is now constituted as follows:

Rev. Wm. H. Campbell, D. D., LL. D., President, and Professor of Moral Philosophy.

George H. Cook, Ph. D., LL. D., Vice President, and Professor of Chemistry, Natural History and Agriculture.

David Murray, Ph. D., LL. D., Professor of Natural Philosophy and Astronomy.

Rev. Theodore S. Doolittle, D. D., Professor of Rhetoric, Logic and Mental Philosophy.

John C. Smock, A. M., Professor of Mining and Metallurgy.

George W. Atherton, A. M., Professor of History, Political Economy and Constitutional Law.

Rev. Carl Meyer, D. D., Professor of French and German.

Francis C. Van Dyck, A. M., Professor of Analytical Chemistry.

Edward A. Bowser, M. S., C. E., Professor of Mathematics and Engineering.

Isaac E. Hasbrouck, A. M., Adjunct Professor of Mathematics and Graphics.

Charles G. Rockwood, A. M., Ph. D., Professor of Natural Philosophy and Astronomy.

James K. Barton, B. S., C. E., Tutor in Mathematics.

Since the date of the last report but few changes have been made in the composition of the Faculty. Professor Murray, having been appointed to the important and honorable position of Commissioner of Education, by the Japanese Government, has been granted leave of absence by the Trustees of this Institution, and still ranks as a member of the Faculty.

Professor Hasbrouck has returned from Europe where he had been paying particular attention to draughting, both theoretical and in its applications to the mechanic arts.

Professor Rockwood, a graduate of Yale College and for several years a professor in Bowdoin College, Maine, has received and accepted an appointment to a chair in this institution, and will enter upon his duties in January. He is well known to many citizens of New Jersey, and brings an excellent reputation as an accomplished scholar and a successful teacher.

Mr. Barton, whose services have been only temporarily engaged, is a graduate of the Scientific School, in the class of 1871. Since his graduation he has been successfully employed in his profession of civil engineering.

II. COURSES OF STUDY AND DEGREES.

Students in the Scientific School may elect either of two principal Courses of Study:

1. A Course in Civil Engineering and Mechanics.

2. A Course in Chemistry and Agriculture.

These courses extend through four years, and include literary as well as scientific studies, the design being not merely to turn out accomplished specialists, though that must always be the main object, but to provide a thorough and liberal education, based upon the study of the mathematical and physical sciences.

The studies of the first two years are the same in both courses, and are so arranged as to meet the wants of young men who desire to become land surveyors, or practical workers in any department of industry, but are unable to spend a long time in preparation. Certificates, of a grade lower than the regular Degree, are given to students who leave at the end of this short course.

A Special Course in Chemistry, extending through two years, is provided for students who wish to devote themselves exclusively to that subject.

In addition to these regular courses, provision is made for Partial Students who may enter at any time, and elect, under the advice and direction of the Faculty, such studies as they may be found qualified to pursue with classes already formed, subject to the general regulations and discipline of the institution and to such examinations as may be prescribed in each case. Such students on leaving receive Certificates stating the studies pursued and the attainments made.

Students completing either of the four years' courses receive the degree of Bachelor of Science (B. S.)

Graduates of three years' standing receive the degree of Master of Science (M. S.) in course.

The degrees of Civil Engineer (C. E.) and Doctor of Philosophy (Ph. D.), are conferred for distinguished professional success, or on examination in prescribed subjects.

III. TERMS OF ADMISSION.

The conditions of admission to the regular courses of study remain the same as for the last two years.

Applicants must be sixteen years of age, and of good moral character, and, if coming from other institutions, must bring certificates of honorable dismission. They must pass a satisfactory examination in English Grammar and Spelling, Geography (descriptive), Physical Geography, History of the United States, Arithmetic, Algebra to Equations of the second degree, and Three Books of Plane Geometry.

The regular examinations for admission to the Freshman Class are held on the Saturday and Monday preceding the annual commencement, and on the day before the opening of the fall term. Candidates for advanced standing are examined in the preparatory studies, and in those already pursued by the class which they propose to enter.

IV. STUDENTS AND STUDIES.

The classes now in the institution are:

First—The Junior Class, organized in September, 1871, which will be graduated in 1875.

Second—The Sophomore Class, organized in September, 1872, which will be graduated in 1876.

Third—The Freshman Class, organized in September, 1873, which will be graduated in 1877.

It has been mentioned in former reports, that the course of study had been changed from three years to four, by the concurrent action of the State Board of Visitors and the Trustees of the College. The present Freshman Class is the third that has entered upon the new course, and there is accordingly no Senior Class now in the Institution, and there will be no graduating class in 1874.

The Junior Class now consists of fourteen students; the Sophomore Class, of eleven students; and the Freshman Class, of twenty-three students; making a total of forty-eight now in attendance.

There have been in the Institution during the year, including the last graduating class, sixty-nine students; of whom four were from Japan, one from the State of Illinois, one from Connecticut, seventeen from New York, and the remaining forty-six from the State of New Jersey, respresenting thirteen counties, as follows:

Atlantic,	1
Bergen,	1
Essex,	2
Gloucester,	3
Hudson,	4
Hunterdon,	1
Mercer,	1
Middlesex,	16
Monmouth,	1
Morris,	3
Ocean,	1
Somerset,	2
Union,	10

During the past year, the friends of education in many portions of the State have expressed their great satisfaction in the growing prosperity of the Institution, and have interested themselves in calling the attention of promising young men to the advantages here offered them, under the patronage of the State. It is believed that still more might usefully be done in this direction, by the various county superintendents who have, under the law, the right of appointment to the State scholarships, and by others who have no official responsibility in the matter, but are interested in the educational advancement of the young men of the State.

It cannot be too often repeated that, as the avowed design of Congress in the appropriation of a small portion of the public lands to the support of education, under the act of 1862, was to promote the welfare of the industrial classes by providing for them "a liberal and practical education in the several pursuits and professions in life," so the whole aim and tendency of the courses of study adopted in the institution, are practical instead of professional. From the beginning to the end of his course, the student receives a large amount of training in the practical work of the field and laboratory, and all branches of learning are constantly taught with reference to their applications. The excellent results of this system, as has been mentioned in former reports, are shown in the fact that our graduates, almost without exception, readily find employment in the line of their chosen occupation or profession, and nearly all of them are now filling useful and honorable positions in this and other States.

At the same time it should be observed that the Trustees and Faculty have steadily kept it before themselves as an object of prime importance, to give the young men entrusted to their charge *an education* as sound and thorough as that furnished in the classical department; the difference between the two consisting not so much in the methods of instruction as in the nature of the subjects which make up the respective courses of study.

V. THE LAST GRADUATING CLASS.

At the last Commencement of the College, June 18th, 1873, the degree of Bachelor of Science was conferred upon the thirteen members of the graduating class. Theses were prepared by them and read before the State Board of Visitors, as follows:

Oswald Haldane, Cold Spring, N. Y., "The Manufacture of Iron."

James T. Lillis, Hudson City, N. Y., "The Improvements adopted in the Water Works of Jersey City."

Henry A. Neilson, New Brunswick, N. J., "Clay; its Products, Uses and Manufacture."

M. R. Chauncey Peck, Albany, N. Y., "The New Capitol at Albany."

Clarence Peters, Newark, N. J., "Zinc and its Manufactures."

William P, Stephens, Rahway, N. J., "Light Bridges."

Charles F. Stillman, Plainfield, N. J., "The Adulteration of Medicines."

Thomas B. Stillman, Plainfield, N. J., "The Ashes of Plants."

Charles T. Van Santvoord, New York City, "The Compound Steam Engines."

Elbridge Van Syckel, Jr., Bound Brook, N. J., "Pettit's Stiffened Triangular Truss."

Herbert F. Watson, Clayton, N. J., "The Truss in the Railway Bridge at Hightstown."

William Williamson, New Brunswick, N. J., "Plan and Specifications for a New Bridge of Stone and Iron for crossing the Raritan at New Brunswick."

Mr. Chapman, of the same class, was excused from the preparation of a Thesis, on account of serious illness.

The two prizes offered by the Professor of Mathematics were awarded: the first to Mr. Van Syckel; the second to Mr. T. B. Stillman.

To Mr. T. B. Stillman was also awarded the prize of one hundred minerals, offered by the Professor of Chemistry to the member of the graduating class who should be able to identify and name the largest number of them.

VI. THE AGRICULTURAL DEPARTMENT.

A full statement of the operations of this department for the past year, and its condition at the present time, will be found in the accompanying report of Dr. Cook, the Professor of Agriculture. It is sufficient in this place to say that the farm is now in better condition than at any previous time, and that its results, as an experimental farm, are not only becoming each year more important to the agricultural interests of the State, but are attracting increased attention. We have abundant evidence, too, that the work of this farm is highly appreciated by large numbers of the most intelligent farmers in the State; and the more, as it becomes more generally understood.

It may not be out of place to remark in this connection, that a mistaken impression seems to exist in some quarters, to the effect that the maintenance of the College farm is in some way, or has been, an expense to the State. Those who have taken the least pains to inform themselves are aware that this is an error. Neither the State of New Jersey, nor the United States, has ever contributed a cent to the purchase or maintenance of the farm, but the entire amount has been furnished by the Trustees, in accordance with the requirements of the State law by which the proceeds of the Congressional land-scrip were appropriated to this Institution. Every dollar that has been received from the State, has been expended exclusively for the salaries of Professors in the Scientific School, the Trustees providing farm, buildings, apparatus and all appliances of every name or kind, employed in the instruction of students.

VII. NEW CHAPEL, LIBRARY, &C.

In the last annual report, mention was made of the then recent completion of the new Geological Hall, and the important addition thus made to the working facilities of the Institution. A new chapel and library, the gift, by will, of the late Mrs. Sophia Astley Kirkpatrick, was expected to be ready for dedication at the Commencement in 1873, but, owing to some unavoidable delays, the work is only now at its completion. December 3d has been fixed as the date of dedication. The building contains a chapel capable of seating about five hundred persons, a library, a reading room, and rooms for the president's private office and recitation room. Some of the most urgent wants of the Institution will thus be supplied for many years to come, and it is hoped that its increasing resources may result in a still greater increase of usefulness to the cause of sound and liberal learning.

The amount received from the State Treasury for the fiscal year ending October 31st, 1873, is six thousand nine hundred and sixty dollars ($6,960), which has been expended exclusively for the salaries of Professors in the Scientific School.

All of which is respectfully submitted.

WM. H. CAMPBELL,
President of the Board of Trustees.

New Brunswick, N. J., November 19, 1873.

APPENDICES.

APPENDIX A.

ANNUAL LECTURE FOR 1873.

"WHAT WE ARE DOING ON THE COLLEGE FARM THIS YEAR."

BY GEORGE H. COOK.

EXPERIMENTS.

At our meeting in November, last year, I had the honor of reading a paper before you on Indian corn and of giving the results of experiments made upon the growing crop, with some special fertilizers. These experiments were made upon a plot of one and a quarter acres of ground. It is a rather heavy soil, with many small stones in it, underlaid at the depth of three or four feet by red shale; and the soil is from the disintegrated substance of that rock, mixed with lighter colored sand and gravel. It has been very stubborn and poor, but has been cultivated from year to year, and lightly manured. Last year it had on it a moderate crop of mangold-wurzels, and this spring it was manured evenly and lightly with barnyard manure, plowed and planted with corn. The rows were four feet apart, and the corn was planted in drills, two stalks being finally left every sixteen inches. For convenience in cutting and putting in shocks, six rows together were manured with the same fertilizer, except the thirty-seventh and last row, which was an odd one, and manured alone. It was planted the 19th of May, and the fertilizers put on the surface of the hills of corn the same day.

No. of plot.	Manure per acre in lbs.	Shelled corn per acre.		Gain per acre.	Stalks per acre in lbs.
		Pounds.	Bushels.	Bushels.	
1	250 plaster........................	5804	82	3	5978
2	Nothing...........................	5505	79		6000
3	500 Superphosphate of lime	5118	73	6 loss	6061
4	250 Muriate of potash........	5532	79		7104
5	250 Sulphate of ammonia....	5918	85	6	4638
6	375 Amm. super. phos. lime	6441	92	13	6057
7	360 Dried blood................	7083	101	22	5833

The field was all cultivated in the same way, and the crops of corn and stalks harvested alike, and the grain as well as the stalks weighed.

The corn all started quickly and looked vigorous and thrifty throughout the season. The muriate of potash evidently hurt the growth of that to which it was applied, some of the plants on which it was put, wilted and died within the first two or three weeks. This fertilizer should have been sprinkled along in the drill, or else sown broadcast over the whole ground. The sulphate of ammonia also caused some injury to the growing corn. Aside from this, I was not able to see any difference in the growth of the stalks, nor was there any decided difference in the time of ripening. The corn was cut up and put in shocks at the end of September, and the last of it was husked on the 31st of October, and the stalks weighed the 4th of November. There was no soft or unripened corn. Short ears and nubbins were most abundant on the plots where the crop proves to have been the lightest. The corn was weighed, and seventy pounds allowed for a bushel.

The fertilizers used are such as I judged would be representatives of the three most important and expensive manures, viz., potash, ammonia and phosphoric acid. The *phosphate of lime* was made for me by Russel Coe, of Linden, from bone-black, and contained twelve and six-tenths per cent. soluble phosphoric acid, six and three-tenths per cent. insoluble phosphoric acid, and no ammonia or potash. The *muriate of potash* was bought of John Ralston, 170 Front street, New York, and contained forty-nine per cent. of potash, with no ammonia or phosphoric acid. The *sulphate of ammonia* was also bought of John Ralston, and was almost pure, containing only two or three per cent. of water, and no potash or phosphoric acid; the ammonia in it amounts to twenty-five and four-tenths per cent. The *plaster* is used because the superphosphate of lime always has plaster in it, which is made from the lime in the bones and the sulphuric acid used in the manufacture, and any effect from the superphosphate used might be due to the plaster in it. The *commercial superphosphate* used had the composition given in the following analysis:

ANALYSIS OF STERNFEL'S AMMONIATED DISSOLVED BONE.

	(1.)	(2.)
Soluble phosphoric acid,	6.90	8.27
Insoluble phosphoric acid,	3.77	3.83
Sulphuric acid,	19.55	23.18
Chlorine,	2.17	
Lime,	13.44	
Magnesia,	.36	
Iron and alumina,	.90	
Soda,	3.91	3.99
Insoluble matter	3.90	

Organic and volatile matter,	20.61	21.53
Water,	23.70	17.32
	99.21	
Ammonia,	2.42	2.61

This was sent from John Ralston & Co., 170 Front street, New York, for trial, and was made at Kalbfleisch's Chemical Works, in Williamsburg. The second analysis is the one printed on the label of the bag, and was made by Professor S. W. Johnson, of New Haven, from the manufacturers' sample, and they guarantee all of their superphosphate to be equal to this standard. Our specimen, as the comparison shows, is nearly equal to the representation. It is a good fertilizer, and was used in this experiment, to show the effect of an ammoniated phosphate.

The *dried blood* is from the abattoir at Communipaw, and was sent to us by the Manhattan Manufacturing and Fertilizing Company, 166 Front street, New York, and I have no reason to doubt is what it professes to be—blood from the slaughter-house, dried, so as to be convenient for transportation or storage. The manure contained

14.42 per cent. of ammonia,
.70 per cent. of phosphoric acid,
.50 per cent. of potash,
1.00 per cent. of soda.

It is a powerful manure, as appears both from the analysis and from the result of our experiment.

These do not give any very decided indications of the effects of the fertilizers on the amount of grain raised, but the weight of the stalks on the part manured with muriate of potash (chloride of potassium) was decidedly greater than on any of the other plots. On this account I have thought it best to repeat the experiments with muriate of potash again this year. The ground selected was a sandy loam, and had been in beets last year. It was not manured this season. The plots were about one-third of an acre each, and six were used. The corn was planted in rows four feet apart, and the single grains put about a foot apart in the rows. The fertilizers were applied on the hills soon after the corn was covered with earth, three hundred pounds per acre of each were used. The corn grew fairly and the following is the result of the trial.

FERTILIZERS USED.	Bushels of Corn per Acre.	Pounds of Stalks per Acre.
Chloride of sodium, *common salt*,	56.9	4174
Sulphate of soda, *Glauber's salts*,	63.1	4210
Chloride of potassium, *muriate of potash*,	58.7	4646
Sulphate of potash,	56.8	3817
Nothing,	63.9	3945
Blood guano,	62.3	4205

The stalks grown where the chloride of potassium was used, are again the heaviest. It is possible this increase is accidental, and I propose to repeat the experiment another year. If muriate of potash does specially increase the weight of stalks, it is important to know the fact, for it may be used to promote the growth of the stalks of hay and grain, causing them to stand up better, and to yield a greater weight per acre.

These results show plainly that it is not easy to get conclusive experiments in agriculture. There are so many circumstances to change the results that it needs repeated trials before we can be sure of our conclusions.

FERTILIZERS.

German Potash Salts.—There is a very common and decided opinion among farmers, that potash is a valuable fertilizer. The opinion is founded on knowledge of the good effects of wood ashes on crops, and the belief that the potash in the ashes is the cause. The opinion is probably not correct, for leached ashes which contain scarcely anything valuable except fine carbonate of lime, are liked as well as live ashes. Still, as the opinion exists, and potash from the German salt mines has come into market at lower prices than it formerly brought, there is a general desire to know the effect of these salts and how to use them. We have made some trials with them this year. What we had were from Stassfurt, in Germany, had been prepared for farm use, and cost $25 a ton. A sample analyzed contained

Sulphate of potash,	21.88	per cent.
Sulphate of lime,	2.59	"
Sulphate of magnesia,	8.97	"
Chloride of magnesium,	7.37	"
Chloride of sodium,	36.97	"
Insoluble matter,	2.73	"
Water and loss,	19.49	"
	100.00	"

The effects produced were not very striking. The beets and carrots upon which they were applied, looked remarkably well, the potatoes were damaged by the excessive rains, and no conclusions could be drawn from them. These salts must be tried further both singly and in combination with other fertilizers, but I would not advise experiments with them on a large scale.

A number of other fertilizers have been tried on our farm. I will here give the method of computing their value, and then give some particulars in regard to their analysis, values, and the experiments made with them.

Prices used in the Valuation of Manures.—These prices are nearly those which have been used by the leading agricultural chemists in our country. Prof. S. W. Johnson, of New Haven, Prof. Peter Collier, of Vermont, S. L. Goodale, Esq., of Maine, Prof. C. A. Goessman, of Massachusetts Agricultural College, Amherst, and others in our own country and abroad have considered these as the nearest approach to the true value of the fertilizing elements of manures that can be made at the present time.

The price of that called *insoluble* phosphoric acid is not satisfactory. If it is in the mineral phosphate it is almost worthless; if in coarse fragments of bone, the price is not too high. What is called reverted phosphoric acid includes all that will dissolve in a solution of citrate of ammonia, both that which was once soluble and that which has changed to insoluble, and the fine bone dust.

Ammonia 25 cents per pound.
Soluble phosphoric acid 16 cents per pound.
Reverted phosphoric acid 13 cents per pound.
Insoluble phosphoric acid 6 cents per pound.
Potash 7 cents per pound.

These are the only substances which are considered worth taking into account in estimating the value of commercial manures which sell for more than $15 a ton. The prices named are for the substances when they are in forms to decay and dissolve quickly and easily. If they will not decay in a reasonable time they are worth less and may be of no value at all. Leather has in it the elements of ammonia, yet it decays so slowly as to be worth nothing for manure. Granite rocks contain a good deal of potash, but their decay is so slow that they are considered of no value for manure. And phosphoric acid is found in many minerals, where it is so solid as to be of no account as a fertilizer. The ammonia in horn, hair and other substances which decay slowly is worth something but not so much as that in guano. Potash in green sand marl has some value, but not so much as it has in the *soluble potash* of commerce. The phosphoric acid in bones and in green sand marl has some fertilizing effect, but it is not so valuable as the soluble superphosphate of lime.

Other constituents of manures have some value, which in those of lower price will necessarily be taken into the account. Ground gypsum or plaster is worth with us a half-cent a pound. Common salt is worth about the same. Lime is worth from a quarter to a half-cent a pound; and the carbonaceous or strawy vegetable part of our barnyard manures is indispensable, though it is not possible for chemists to assign to it a value which will at all show its usefulness on different soils.

Stable Manure.—The chief reliance for manures must still be from the stable and the barnyard. and it is only when a good supply of this kind of manure can be secured that farming can be carried on profitably. I present here for comparison and valuation the analysis of well rotted stable manure. It is copied from Prof. S. W. Johnson's Essay on Manures, p. 81:

ANALYSIS.

Phosphoric acid,	.45
Potash,	.49
Ammonia,	.73
Soda,	.08
Lime,	1.99
Magnesia,	.14
Oxide of iron and alumina,	.67
Sulphuric acid,	.12
Carbonic acid,	1.40
Chlorine,	.02
Soluble silica,	1.68
Sand and earthy matter,	1.01
Organic matter,	15.80
Water,	75.42
	100.00

Valuation for one ton:

9 lbs. phosphoric acid, at 16c.,	$1 44
9.8 lbs. potash, at 7c..	68
14.6 lbs. ammonia, at 25c.,	3 65
	$5 77

This is only the estimated value of the three high priced constituents. A part of the value of stable manure is due to the organic matter which it contains. From the estimated value it will be seen that it is worth more than the price usually paid for it. It acts more like an ammoniacal manure than a phosphatic one; it tends more to develop the leaves and stalks of corn, grain and grasses, than to increase the quantity of grain. We use it most on sowed corn and on root crops. This year we have just gathered in the crop of beets from 3 acres of ground, manured with 16 loads of stable manure to the acre, and find our crop to be 1,843 bushels. The yield has probably been somewhat increased by the use of potash salts on the ground, but it is mainly due to the stable manure. Another year we shall probably diminish the area of land planted to beets, and manure it more highly. We have 3 acres of carrots also, raised on ground which has been manured with 16 loads of barnyard manure to the acre. The crop is a good one, 519 bushels to the acre.

Last year we manured heavily a plot of 9-10ths of an acre and sowed it with corn. The crop was very large. It was taken off in August, and early in September, without further manuring, the ground was plowed and sowed with rye, putting on 3 bushels of seed per acre. It was intended for supplying green fodder for the cows. Not being needed for that purpose, it was left to grow and ripen. It was very thick and heavy, some stalks were seven feet eight inches high. The crop drawn in from the field, weighed 9,400 pounds. The grain when threshed yielded at the rate of 47 bushels per acre. The crop is a remarkable one, and shows well the effects of barnyard manure.

Refuse Hair from Glue Factories.—We have used a large amount of hair manure from the glue factories, with good results. It consists mostly of hair, a little plaster and lime, and some small bones scattered through the mass. The sample we analyzed contained

11.6 per cent. of ammonia,
3.7 per cent. of phosphoric acid,
3.7 per cent. of sulphuric acid,
7.8 per cent. of lime.

The hair does decay, though quite slowly, even in a fermenting compost, and I estimate the value of its ammonia at 10 cents a pound. The phosphoric acid is in such solid fragments of bone, that I do not consider it of value.

232 pounds of ammonia, at 10 cents per pound, make the ton of hair worth $23.20; its price is $12 a ton. By composting with its own weight of stable manure it is made to decay tolerably fast; it turns black, gives off a powerful stench and becomes quite rotten. We have raised fine crops of cabbage and turnips by the use of one-third tons of it to the acre. Composted with marl and barnyard manure it makes an excellent top dressing for grass. One of our meadows dressed with this compost three years ago, has improved in quality every year since.

There is perhaps no other commercial manure as cheap as this is. Its smell and the difficuly of rotting it, are the principal objections to its use.

Malt Dust, or Malt Screenings.—We have used this substance as a top dressing on our grass lands, with remarkably good results. It is mostly sold to be fed to cattle, and is a rich food. It is light and bulky, so that it will not pay for long transportation. A bushel weighs 20 pounds, and usually sells for about 20 cents.

We present our analysis so that its composition may be seen, and as it is in good condition for spreading directly on the ground, and decays fast enough, we put the full prices on its fertilizing constituents:

ANALYSIS.

Phosphoric acid,	1.73
Potash,	2.19
Ammonia,	5.60
Soda,	.20
Lime,	.23
Magnesia,	.23
Oxide of iron and alumina,	.17
Sulphuric acid.	.62
Chlorine,	.04
Silica and earthy matter,	1.50
Organic matter besides ammonia,	80.09
Water,	7.40
	100.00

Estimated value of one ton or 100 bushels:

34.6 lbs. phosphoric acid, at 16c.,	$5 53
43.8 lbs. potash, at 7c.,	3 08
112.0 lbs. ammonia, at 25c.,	28 00
	$36 61

When spread on grass land to the amount of 25 bushels or more per acre, its effects can be seen within two weeks, and it acts much like barnyard manure. We tried it also on turnips, and it increased the growth of the tops very much, but had little effect on the turnips themselves. It is so convenient to apply, not in any way disagreeable, and withal of so moderate a price that I think it ought to be more highly appreciated than it now is.

Poudrette.—Dried night soil, prepared without addition of earth or other absorbent, and containing only a little ashes, rubbish and such matters as are thrown into privy-vaults, has been much used in our vicinity, and I here present an analysis and valuation for comparison with other manures offered for sale. An average sample contained

2.23 per cent. of phosphoric acid,
.07 per cent. of potash,
1.11 per cent. of ammonia,

and a ton would contain

44.6 lbs. of phosphoric acid. at 16c.,	$7 13
1.4 lbs. of potash, at 7c.,	09
22.2 lbs. of ammonia, at 25c.,	5 55
Value of one ton,	$12 77

It is sold for 30 cents the bushel, weighing 50 pounds, which makes the price per ton $12. It is quick in its action, the analysis proves it to be a phosphatic manure and experience shows it to be specially favorable to the growth of cabbage. The extreme fineness of the components undoubtedly enables it to produce its effects mainly in the first season of its application.

Whann's Super-Phosphate.—This is a popular fertilizer, manufactured near Wilmington, Delaware, and is very largely used in the western and southern parts of our State. A committee from the Farmers' Club at Mount Laurel, visited the works, and one of them reported to me that the phosphate was made by mixing together

1 barrel of ground raw bone,
" " bone meal,
" " Peruvian guano,
" " cancerine (crabs dried and ground),
" " hoof and horn dust,
Half " salt,
" " sulphate of ammonia,
" ton Charleston phosphate, ground fine,
2 carboys of sulphuric acid.

This phosphate is in fine condition for sowing, being admirably prepared. We used a half ton of it on our wheat in the fall of 1872. This we analyzed:

ANALYSIS.

Soluble phosphoric acid,	3.34
Reverted " "	4.01
Insoluble " "	4.98
Potash,	.40
Ammonia,	3.40
Soda,	3.17
Lime,	15.40
Magnesia,	.47
Oxide of iron and alumina,	1.23
Sulphuric acid,	13.90
Chlorine,	3.50
Organic matter other than ammonia,	23.93
Water,	13.25
Earths insoluble in acids,	9.30
	100.28

Valuation:

66.8 lbs. of soluble phosphoric acid, at 16c.,	$10 69
80.2 lbs. of reverted phosphoric acid, at 13c.,	10 42

99.6 lbs. of insoluble phosphoric acid at 6c.,	5 97
8 lbs. of potash, at 7c.,	56
78 lbs. of ammonia, at 25c.,	19 50
Estimated value of one ton,	$47 14

From 2 4-100 acres of wheat dressed with 800 pounds of this fertilizer, we have this year harvested 73 bushels of grain. The ground had been in meadow five years, and was marled before that. The grass had died out so that it was no longer worth mowing, and the ground was plowed early in August and again about the 15th of September. The wheat was drilled in and no manure was used except the super-phosphate, which was put on just after sowing, and 3 or 4 bushels of salt per acre, which was sown in the spring. The seed was the Fultz, a variety of light red, bald wheat, which has a short, stiff straw, and matures a few days earlier than the common red wheat.

The straw was taller where the salt was applied, but I attribute the large yield of grain to the super-phosphate, and believe the yield would not have been more than 20 bushels an acre without it.

Super-Phosphate of Lime.—From a lot of South American bone-ash, we made some super-phosphate of lime, and have used it on the farm. The ash was just as it came from the vessel, in lumps and small fragments of bone. The sulphuric acid was obtained from a kerosene refinery. The materials were mixed under a roof and were turned over several times before using.

It contained

Soluble phosphoric acid,	2.61
Reverted " "	4.22
Insoluble " "	6.03
Lime,	16.48
Sulphuric acid,	17.39

And its valuation may be

52.4 lbs. phosphoric acid, soluble, at 16c.,	$8 38
84.4 " " " reverted, at 13c.,	10 97
120.6 " " " insoluble, at 6c.,	7 23
	$26 58

The sulphate of lime in it is worth to us $3 or $4, so that it may be valued at $30 a ton. The bone-ash cost $30 a ton, and the sulphuric acid about $20 a ton, so that it cost as much as it is worth. If we had had a mill to grind the bones fine, we might have increased the proportion of soluble phosphoric acid, and so increased its value, but the trouble of procuring small lots of the material, the lack of skillful workmen, and the time required for watching and testing its progress make it unprofitable for farmers to manufacture their own phosphate, and I have no hesitation in dissuading any farmer from undertaking it. It is safer and more economical to buy of reputable manufacturers, and while, from the impossibility of judging of the value of a fertilizer from its appearance or smell, there is a fear that it may not be honestly prepared, I am happy to say that all I have had occasion to test this year, have been fully up to the quality their makers claimed for them. I insert some of them here:

Russel Coe, of Linden, New Jersey, made for us, last year, super-phosphate which contained

12.60 soluble phosphoric acid,
6.30 insoluble " "

Which at the prices given would be per ton,

252 lbs. phosphoric acid, at 16c - - - -	$40 32
126 " " " at 6c - - - - -	7 56
	$47 88

Russell Coe's super-phosphate, prepared for the general market has some ammonia in it, and is worth more than this. He uses burnt bones as his source of phosphoric acid.

The Manhattan Fertilizing Co. of New York, sell a super-phosphate to which a little dried blood has been added. A sample taken from a dealer's stock in New Brunswick, and analyzed in our laboratory yielded of

Soluble phosphoric acid, - - - -	7.98
Reverted phosphoric acid, - - - - -	0.00
Insoluble phosphoric acid, - - - -	2.10
Potash, - - - - - - -	1.70
Ammonia, - - - - - -	3.90

Valuation per ton

159.6 lbs. soluble phosphoric acid, at 16c - -	$25 53
42 " insoluble phosphoric acid, at 6c - -	2 52
34 " potash, at 7c - - - -	2 38
78 " ammonia, at 25c - . - -	19.50
	$49 93

This fertilizer is made from bones; it has given good results on our crops.

Lister Brothers, of Newark, manufacture super-phosphate and bone manures on a large scale. A sample taken from a large quantity of their stock was analyzed with the following result:

Soluble phosphoric acid,	6.57
Reverted " "	1.54
Insoluble " "	4.71
Ammonia,	1.71
Soda,	3.67
Lime,	14.88
Magnesia,	0.62
Sulphuric acid,	17.73
Insoluble matter,	4.62
Organic matter other than ammonia,	29.55
Water,	14.40
	100.00

Valuation of one ton,

131.4 lbs. soluble phosphoric acid, at 16c	$21 02
30.8 " reverted " " at 13c	4 00
94.2 " insoluble " " at 6c	5 65
34.2 " ammonia, at 25c	8 55
	$39 22

This super-phosphate finds a large sale and is well liked. It is made from bones.

Bone flour, *Bone meal and Ground bone*, are the names given by Messrs. Lister Brothers to different grades of ground bones—the first being the finest, the second intermediate and the third coarsest.

The following are their analyses:

	Bone flour.	Bone meal.	Ground bone.
Phosphoric acid,	10.89	11.73	13.35
Ammonia,	3.26	3.22	3.36
Soda,	5.53	3.12	3.90
Lime,	14.48	15.61	17.64
Magnesia,	.75	.55	.48
Oxide of iron and alumina,	.87	.99	.66
Insoluble matter,	3.56	2.52	2.23
Organic matter other than ammonia,	29.80	28.91	31.78
Sulphuric acid,	8.86	9.75	9.40
Water,	22.00	23.60	17.20
	100.00	100.00	100.00

These are all made from raw bones, and more or less animal matter is mixed with them. To keep it from putrifying, nitre cake (sulphate of soda), from the nitric acid works, is mixed with the ground material. This has some effect in softening the bone and rendering it more soluble. Some of the phosphoric acid in each of the specimens is soluble in water, and a much larger quantity is soluble in a solution of citrate of ammonia. Thus the ground bone, in one trial with solution of citrate of ammonia, gave 11.3 per cent. of phosphoric acid, and, in another trial, gave 13.35 per cent. of phosphoric acid. Valuing the ground bone from these results, a ton should be estimated as containing

26.7 lbs. of soluble phosphoric acid, at 16c.,	$34 71
67.2 lbs. of ammonia, at 25c.,	16 80
	$51 51

The selling price is $30 per ton, and the finer qualities are $34 and $40 per ton. They are much liked.

Green Sand Marl.—Some trials have been made upon marl to test the solubility of its phosphoric acid ; Squankum marl, containing 4 per cent. of phosphoric acid, was digested in a solution of citrate of ammonia, and 2 per cent., or one-half of it, was dissolved ; pure crystallized phosphate of lime was ground very fine and digested in a solution of citrate of ammonia, and scarcely a trace of it dissolved. I think then that the phosphoric acid in the green sand marl must be estimated as worth more than the insoluble phosphoric acid of the manufactured phosphates. In the Annual Report of the Geological Survey for 1870, I computed the value of the marl, assuming 9 cents a pound for phosphoric acid and 2 cents a pound for potash. From my own observations upon the effects of marl, as well as the experience of some of our best farmers as to its value, I was led to adopt these as fair prices, and I see no reason yet for changing them.

The following table shows the composition of the marls most largely used in New Jersey, and fairly represents the different beds and varieties:

ANALYSIS.

	1	2	3	4	5	6	7	8
Phosphoric Acid....	1.47	1.60	1.28	2.46	1.34	3.17	4.67	1.14
Sulphuric Acid......	0.00	0.00	1.37	0.17	0.00	0.25	0.51	0.14
Silicic Acid............	50.85	51.10	51.92	57.35	46.82	59.05	52.70	38.70
Carbonic Acid.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.13
Potash................	5.33	6.46	5.36	4.47	5.59	4.72	3.81	3.65
Lime..................	1.65	2.13	1.68	3.36	2.02	4.65	5.52	9.07
Magnesia.............	2.95	3.85	3.38	2.99	3.10	2.66	2.70	1.50
Alumina..............	6.89	9.15	5.40	5.86	6.48	6.67	8.66	10.20
Oxide of Iron.........	21.34	18.20	19.82	15.03	23.93	11.27	15.92	18.63
Water...................	8.40	6.75	8.70	8.20	9.70	7.50	6.40	10.00
	98.88	99.24	98.91	99.89	98.98	99.94	100.89	99.16

1. Marl from the pits of Dickinson Brothers, Woodstown.
2. " " " " West Jersey Marl Co., Barnsboro.
3. " " " " Pemberton Marl Co., Pemberton.
4. " " " " Vincentown Marl Co., Vincentown.
5. " " " " Cream Ridge Marl Co., Hornerstown.
6. " " " " Squankum Marl Co., Farmingdale.
7. " " " " Squankum and Freehold Marl Co., Farmingdale.
8. " " " " at Marlboro, Monmouth county.

The computation of the values of these marls from their phosphoric acid and potash only, shows them to be worth from $3.50 to $8.50 a ton. They are largely used wherever they can be got at prices ranging from $1. to $5. a ton. We have used them on our fields and always with success. They are specially adapted to grass and clover; but all soils are benefitted by them—and I have never yet seen a field worn out that has once been well marled.

Their real value is apparent when they are compared with leached ashes which sell readily at from 20 cents to 25 cents a bushel or $7. to $8.75 a ton, and are prized by all farmers. An analysis of leached ashes made by professor S. W. Johnson, and published in the report of the Connecticut board of Agriculture for 1873, gives as an average,

1 per cent. of potash,
1 per cent. of phosphoric acid,
40 to 50 per cent. of carbonate of lime,
35 per cent. of water.

The valuation of one ton of ashes at the most is

20 lbs.	of potash, at 7c	$1 40
20 "	of phosphoric acid, at 13c	2 60
500 "	of lime, at ¼ cent	1 25
		$5 25

Marls much richer in all the elements of fertilization than these ashes, are sold for $1.25 a ton. The only difference in favor of ashes is their extreme fineness. They are so fine that they can be spread or scattered completely over the surface, while marl when wet spreads very imperfectly, and is never so fine in its particles as ashes. If marl could be ground in a mill so as to reduce its grains of green sand to fine powder, its immediate value would be doubled. And the mechanical engineer that can make a mill to do this work cheaply and effectually, will confer a great benefit on the agricultural resources of New Jersey.

Muck, Peat, Turf, Black Mud.—These are the various names given to the accumulations of vegetable matter which are found in swamps, marshes, and other wet grounds in all parts of our State. Such matter has long been used as a fertilizer, and it still finds a large use in many places. Vineland, Hammonton, Egg Harbor City, and many other places are greatly improved in their cultivated lands by its use. We are just beginning experiments with it at the College Farm, using it as a cheap source of ammonia, and as a substitute for other carbonaceous vegetable matter, in giving liveliness to the soil.

Six specimens from different parts of the State, on analysis yielded an average of one fourth per cent. of the elements of ammonia. They contained very little potash or phosphoric acid. From forty to eighty per cent. was vegetable matter. If the elements of ammonia were in the proper condition for plant food, the twenty-eight pounds in a ton would be worth $7. But the peat is not in a decaying condition, and both skill and time are requisite to fit it for a manure. It needs composting with barn-yard manure, lime or wood ashes before it is fit for use. It can be had on many farms for the mere cost of hauling, and as the skill of the farmer can make it worth as much as an equal quantity of the best stable manure, it certainly offers large inducements to use it wherever it can be had.

I should have been glad to examine many other of the fertilizers prepared or found in our State, but the limited means at my disposal prevent me from going further this year. Much more ought to be done, and more could be done if the means provided were larger. More extended investigations could be made upon fertilizers, and more careful experiments upon their adaptation to our soils and crops.

Potatoes grown upon land which consists in whole or in part of red shale earth are not a paying crop; not at all equal in quantity or quality to those grown in other soils of the State; though the soil itself is quite as good for most other crops. The difficulty I think can be found out and obviated.

Our crops of oats are no better than they were fifty years ago. We have improved in raising wheat, grass and other crops, but oats are not raised to any better advantage, in this or any other country now, than they were before the days of improved agriculture. The studying out of this problem is within the sphere of the Agricultural College, but it will be both tedious and expensive.

Our common rotation of grass, corn, oats, wheat and grass is not founded on correct principles. These crops all belong to the same natural family of plants, and draw upon the same constituents of the soil, so that it has no rest, such as it has when potatoes, beans or peas, turnips and cabbage, or clover, all of which belong to other natural families of plants, are made a part of the rotation. I propose a careful trial of some varieties of field beans or peas that will pay as feed or fertilizer, to substitute for oats. A substitution of this sort would make the wheat crop alone worth as much as the present wheat and oats together, besides improving the soil, and increasing the produce of the farm. This change of practice can only be made successfully by time, study and experiment.

The whole matter of our soils, their adaptation to particular crops, and the peculiar fertilizers each needs, is to be continually studied and improved. Our soils on granite, lime-stone, slate, sand-stone and shale, trap, clay, marl, drift and alluvium, differ from each other, and to farm them intelligently and profitably they must be studied in the laboratory and the field. The expense for manures on some of them is vastly more than on others, while the cost of tillage may be much less. Other questions which need investigation, and such as are out of the line of individual farmers, are constantly rising, and they can only be solved in places and by men specially devoted to them. Such answers will naturally be looked for from the Agricultural Colleges, and such we are beginning to furnish.

There is, however, a remarkable misapprehension in regard to our Agricultural College Farm. Many intelligent men suppose the farm was purchased by the State, and with funds given by the United States Government. Under this impression, some of our friends even in this club have given pretty wide publicity to their opinion, that the College Farm was not doing as much as it ought for the farmers, considering what the government had done for it.

The fact is, neither New Jersey nor the United States Government has ever given one cent to purchase or support the College

Farm. Government lands were given by the United States to endow colleges for the benefit of agriculture and the mechanic arts. The State of New Jersey received the land-scrip, sold it and holds the funds realized from the sale. The Legislature has given the interest of this money to Rutgers College, with the condition that it shall be used solely for the payment of teachers' salaries in Rutgers Scientific School, and that none of it shall be used for the purchase or support of a farm. But the Legislature did require that Rutgers College should purchase and support a farm at its own expense. The Trustees of the College purchased the farm from their own funds. A small part only of its original cost was returned to them in the donations of its friends. The Trustees have carried out their engagement faithfully. They bought a farm of poor land at a high price because it was near the city and easily reached. They have spent a large sum of money in clearing, draining and enriching it. Every acre of it is now under cultivation and ready to be used for the legitimate purposes of an experimental farm. And whatever it is now doing for the cause of agriculture, is by the support of the Trustees of Rutgers College. We shall be glad to have farmers and those interested in agriculture, visit the farm. I am there on Wednesdays, and the Superintendent will always take pleasure in showing everything of interest.

The Scientific School, which is partly sustained by the fund from the United States Government, is doing its work successfully and usefully. We have in the school a number of young men from the different counties who are enjoying the advantages of tuition paid by this fund. They are all, without exception, men who intend to engage in some industrial occupation, as engineers, surveyors, farmers, chemists, architects, draughtsmen, or in any other business in which they can turn their education to profitable account. And very few of them would have been educated but for the free tuition of Rutgers Scientific School and the State Agricultural College. Most of them think they will not be farmers because they cannot get as good pay in farming as in many other pursuits; but as we train them in the principles of chemical, physical and other natural sciences, we consider them fitted to learn practical agriculture; and we are gratified to know that many of those who have tried other pursuits, come back to farming as on the whole the safest and most paying occupation.

APPENDIX B.

Report of the Agricultural College Farm for 1873.

The farm remains as at the date of the last report, viz.: consisting of ninety-nine acres, located in the southern suburbs of New Brunswick, and a mile and a half from the college buildings and from the railroad depot. The whole of the land is now in use and ready for cultivation in any of the staple farm crops. There is no waste land upon it; it is without any internal division fences, except a lane from the barn yard to the back end of the farm, which is for convenience in driving cattle to any part of the farm. The five-acre field which was last year in stumps has now been cleared and plowed, and a crop taken from it; so that this expensive part of our land improvements is completed for all the farm.

Some of the drains in this newly cleared ground were laid with one inch, and one and a half inch pipe tile. The surface of our back fields is quite flat. We had very heavy showers the latter part of July and the first half of August, and the drains proved to be entirely too small to carry off such a quantity of water as fell, quick enough to prevent it from damaging the growing crops. In ordinary seasons such pipes are large enough to carry off the water that falls in showers—but for such extraordinary falls of rain much larger pipes are needed. We shall not again lay any round tile of less than two inches diameter, and our outlet pipes will need to be at least six inches. Last year the very fields which have now suffered from the water on them, grew very good crops, which were not at all damaged by rain.

The extraordinary rain referred to, will be appreciated by an examination of the records of rain fall which I here give as they were copied from the register of P. Vanderbilt Spader, Esq., of New Brunswick:

1873.	Depth of rain in inches.	1873.	Depth of rain in inches.
July 27,	0.66	Aug. 15,	0.02
" 28,	1.64	" 16,	0.12
" 29,	3.64	" 17,	0.05
Aug. 1,	0.14	" 18,	0.14
" 2,	0.01	" 19,	1.20
" 3,	0.35	" 20,	0.29
" 8,	0.10	" 21,	2.01
" 13 & 14,	5.29	" 22,	0.04
		" 23,	0.27

The amount of rain fall from July 27th, to and including August 14th, a period of nineteen days, is eleven and eighty-three one-hundredths inches. Our average rain fall per month is about four inches, so that this is nearly five times the usual amount, and almost half of it fell on the 13th and 14th, and three inches fell in two and a quarter hours on the 14th. The flat grounds were flooded, and this heavy rain being followed by nine cloudy and rainy days left no time for the ground to drain or dry. Part of our crop of carrots and potatoes was ruined, and our cabbage and turnips damaged to a very large amount.

CROPS.

Wheat.—We had two fields in this crop, one of two acres and the other of fifteen acres. The two acre field was in meadow last year, and the grass being very poor, it was thought best to plough and reseed it. The ground was ploughed in August, and again in September, and was sown to wheat September 18th. The wheat was drilled in, and the ground dressed upon the surface with 400 pounds per acre of Whann's super-phosphate of lime. In March it was again dressed with salt at the rate of three bushels an acre. The crop grew well and the straw stood up stiff and strong. It ripened three or four days earlier than the common red or Mediterranean wheat, and, yielded thirty-six bushels to the acre. This is the second year we have grown this variety of wheat and it has done well both years. It is a bald wheat, with a light colored short and stiff straw, and gave no indication when standing of yielding so well. The seed was received from the Department of Agriculture, and in our experience it proves to be better than any we have before cultivated.

The fifteen acre field was, last year, half in potatoes which were well manured with a compost of hair, barn-yard manure, and green sand marl; the other half was in oats. No manure was put on the potato ground; the oat ground was partly dressed with the hair compost. The wheat was the common Mediterranean variety, and was drilled in at the rate of one and a half bushels to the acre. Thick and heavy ice formed on many spots in the field during the winter, and remained so long as to kill much wheat. The yield was twenty bushels to the acre.

Rye.—We have found rye a good crop for early green fodder. It heads out about the 12th of May, and may then be cut profitably, and for a month onward it is the best crop for soiling cattle. Nine-tenths of an acre had been well manured from the barn-yard, in the spring of 1872, and then sowed with corn for fodder. A heavy crop was grown and consumed. Early in September the ground was again plowed, and without further manuring, was sown with rye at the rate of three bushels to the acre. This spring the crop was not needed for fodder, and was allowed to stand and ripen. It was very thick and tall; some of the straws being seven feet eight inches high. It stood up well till ripe and was only knocked down by a heavy shower, three or four days before harvest. It was cut by the reaping machine, and was weighed when ready to draw into the barn. Its weight was 9400 pounds, or more than four and a half tons of grain and straw. The grain yielded forty-seven bushels per acre; worth seventy cents a bushel, or $32.90. The straw was sold for $15 a ton, making about $45 worth on an acre. This makes the value of an acre of rye and straw $77.90, a good and profitable crop of this grain which is usually thought to be fit only for the poorest ground.

Oats.—Five acres of oats were raised on the newly-reclaimed ground. The early part of its growth was checked by drought, and it only yielded 137 bushels. This grain has not yielded a paying crop with us at any time. It must be the subject of further experiment both in tillage and fertilization.

Indian Corn.—Eleven acres of ground were cropped with corn. A part of it was the poorest and least improved ground on the farm, and two acres of it were left unmanured for experiments. About three acres of it were in poor and cold meadow last year; four acres were in turnips, and the rest was in beets. We have harvested 1,200 bushels of ears of sound corn. Our supply of barnyard manure being exhausted, the corn was manured with blood guano, at the rate of 500 pounds an acre, partly on the hills soon after planting, and partly broadcast at the second cultivating the corn.

A series of experiments made last year, indicated that the weight of corn-stalks was considerably increased by the use of chloride of potassium. These experiments were continued this year, only varied so as to see whether the increase should be attributed to the chlorine or the potassium. Trials were made with chloride of sodium (salt), sulphate of soda (Glauber's salts), chloride of potassium (muriate of potash), and sulphate of potash, applying them at the rate of 300 pounds per acre of each. The results show that the greatest weight of stalks was on the plot manured with muriate of potash, the same as last year. The particulars of the experiments are detailed in the accompanying lecture. Further experiments must be made with this salt next year; not only on corn, but on grain and grass. If it should prove a specific for the straw of these crops, it will be a useful addition to our list of fertilizers. It is imported from Germany, and sold for about 5 cents a pound.

Potatoes.—Five acres were planted with potatoes, on the new flat ground at the south end of the farm. They came on finely at the beginning of the season. Being well manured with a mixture of German potash, salts and super-phosphate of lime, it was hoped they would yield an abundant crop, but the heavy rains of July and August damaged them so that they were scarcely worth digging.

Two acres on the high ground, near the barn, yielded a fair crop of early rose potatoes—240 bushels. For the labor and manure spent on this crop, it does not give an adequate return.

Hay.—Twenty-five acres of the farm are in meadow. This season was dry in its beginning, and the grass crop was shortened by it. Seven or eight acres were mown the second time, yielding a burden nearly equal to the first crop. I estimate the whole amount of hay made, at forty tons.

Carrots.—Three acres were cultivated in carrots. The crop was 1,557 bushels. The same plot has been used to grow carrots for three years in succession. On account of the expense of weeding, it is desirable to get as clean ground as possible; and this we do to the best advantage by taking ground which has been kept clean, in previous years, by weeding. The ground was manured with 16 two-horse loads of barnyard manure per acre, which was plowed in and well mixed by a second plowing. Before ridging, it was sown with 600 pounds per acre of the mixture of potash salts and super-phosphate of lime. Gathering the surface into ridges brought most of the latter dressing near the seeds, which were drilled in on the ridges; May 19, the seeds were put in, and this I am satisfied was none too early.

Though grown on the highest and apparently the driest part of the farm, they suffered from the extreme wet weather. The carrots were much shorter than in former years, and in most of them the tap root was wanting, and its place was supplied by several lateral or branching roots. The tap root had evidently been killed by water in the subsoil. The carrots were diminished in amount, perhaps one-third, and are not so smooth as usual; still the crop is over 500 bushels to an acre, and may be counted a good one. I do not think there is any failure on account of continuing the crop on the same ground from year to year, but the soil must be made deeper, and the subsoil be more thoroughly loosened, so as to allow the rain water to sink through it easily, and the tap root to grow in it. If the ground does not freeze too early this fall, we shall plow and subsoil it, and then put on 20 two-horse loads of manure to the acre, and let it lie exposed to the winter.

Sugar Beets and Mangold Wurzels.—Forty-eight hundredths of an acre of ground were planted with Silesian sugar beet seed. The ground was manured with sixteen loads of barn-yard manure to the acre, and with six hundred pounds to the acre of a mixture of equal parts of German potash salts, and super-phosphate of lime. The seeds were planted May 18th, came up well, and grew without check through the whole season. The weight of crop was 14,739 lbs. or 245 bushels of 60 lbs. each—or at the rate of 500 bushels per acre. The beets are very sweet, yielding with our imperfect means of extraction 8 per cent. of sugar. Eight per cent. amounts to 2,400 lbs.

of sugar to the acre, which would be worth more than $200. The manufacture of sugar from beets, must soon be started among us. We can raise the beets successfully; we only need the skill and capital to start the manufacture.

Two and a half acres were planted with mangold wurzel beet seed. The ground was manured the same as for sugar beets. A small part were long red mangolds—but most were of the yellow globe variety, and these have so far proved to yield the best on our ground. The crop was a very good one, amounting to 1600 bushels, or 640 bushels to the acre. The potash salts, I have no doubt, helped to keep up the healthy and vigorous growth of the plants, but I think that probably salt would have done as well, as the crop on a neighboring farm where salt was used was quite as vigorous. Mangold wurzels keep well, and furnish a better green food for our milch cows, through March, April and half of May, than we can get in any other way; turnips and cabbage not keeping so well, though they can be grown at less expense; and carrots cost more and are not materially better. The mangolds from an acre weighed 19 tons and are equal to 9½ tons of hay.

Cabbage.—We had five acres in cabbage. The ground was new, having only been plowed twice before, and cropped with corn. It was manured with a compost of hair and stable manure, and plowed twice. Heavy showers filled the ground with water which drained off slowly, and the cabbage were damaged so that there was not a quarter crop. Corn grew well on this ground, and cultivated grasses thrive on it, but cabbage needs a dryer soil and a more open subsoil.

Turnips.—Six acres were in ruta-baga turnips. The ground was well manured with hair compost, the seed planted in good mellow earth, and super-phosphate of lime was drilled in the rows. Planting was done on the 24th of July, and they came up well, but for more than two weeks there were frequent rains, scarcely any sunshine, and the plants were damaged besides losing this best season of the year for growth. They came on afterwards, but could not regain the lost time. The crop amounts to 836 bushels, not much more than a quarter of what it ought to have been. The quality of ruta-bagas for market is so much better if they are grown quickly and not too large, that we have tried to plant as late as possible. The common turnip and the yellow or gray stone turnips are much easier raised and a surer crop, but the market for them is so limited that we have preferred to try the better but more difficult kind.

Fodder Corn.—Three sowings of corn have been made and about two acres in all grown. It answers an excellent purpose, and is our dependence for green fodder from the middle of July till frost comes. Rye sown thickly answers for a month from the middle of May, and clover and grass for another month, but from that onward the fodder corn is our cheapest green food.

STOCK.

Horses and Mules.—The work of the farm is done by two teams, one of horses and one of mules. Our experience is in accordance with that of the people of our State generally, that mules are the best and most economical for general work either on the road or the farm. The change which is taking place in our State in the use of horses, mules and oxen for farm work, is shown in the Census Reports for 1850, 1860 and 1870, in which the number of these animals on farms in New Jersey, is given as follows:

DATE.	HORSES.	MULES.	OXEN.
1850	63,955	4,089	12,070
1860	79,707	6,362	10,067
1870	79,708	8,852	3,830

Cows.—The number of cows kept on the farm is 12. The milk is sold in town, and no butter or cheese is made. The quantity of milk given by each cow in each month of the year, is set down in the following table, with the whole amount for the year, and the present weight of each animal in pounds.

MONTHLY YIELD OF MILK IN QUARTS:

NAMES.	1872		1873										Years' yield.	Daily ave'ge.	Weight of Cows.
	Nov.	Dec	Jan.	Feb	Mar.	April	May.	June.	July.	Aug.	Sept.	Oct			
Belle	....	......	432	462	465	390	341	300	186	139	30	......	2,745	7½	1,120
Grisette	75	......	....	......	554	600	527	465	418	387	315	217	3,558	9¾	1,050
Nelly	285	232	186	98	....	....	....	210	387	217	180	217	2,012	5½	883
Nelly	240	186	62	......	....	....	280	382	341	310	262	210	2,273	6¼	912
Mag	270	248	217	168	139	....	....	....	288	472	450	418	2,670	7⅓	958
C. (English).	....	......	372	420	449	390	341	315	301	341	315	224	3,468	9½	1,190
Bergen	225	217	279	238	255	105	....	....	....	480	487	410	2,696	7⅓	1,000
Bess	315	263	186	154	93	....	542	555	480	527	457	410	3,982	10¾	908
Marlin	345	310	232	238	270	225	232	210	124	62	....	......	2,248	6⅛	1.020
Newark	315	294	232	182	170	60	....	....	....	232	240	208	1,963	5⅓	908
Red	345	279	279	266	301	240	301	225	162	100	53	......	2,551	7	905
Gebhard	75	......	403	336	363	300	263	210	146	100	30	......	2,226	6⅒	1,160
Yearly average of the twelve cows													2,699		

The first five in the list are Ayrshires, and three and four are very old. English is an imported short horn; she was brought over in 1871, February, and had not fully recovered from hardships of the passage till this year; she is now one of the best cows on the farm. Another short horn cow imported with this one, never recovered from injuries received on the voyage, and died this summer. The rest of the cows are of stock purchased here, though Bergen is evidently a grade short horn, and Gebhard a grade Dutch cow. We have a number of full-blooded Ayrshires to come in this year, and purpose to fill our herd with cows of that breed.

IMPLEMENTS.

A hay-tedder has been added to the implements the past year, by purchase from the Staats, Melick & Co. Manufacturing Company, at Raritan. Other implements remain as at the date of the last report.

FERTILIZERS.

Every effort has been made to increase the supply of barnyard manure, and the amount gathered and used has been very large. In addition to this, we have purchased and used glue makers' waste, malt-dust, super-phosphate of lime, blood guano, German potash salts, sulphate of ammonia, muriate of potash, Glauber salts and common salt. For particulars relating to these fertilizers, I refer to the appended lecture, in which the composition, valuation and use of each are given in detail. I may remark in regard to the fertilizers, that our most satisfactory and profitable crops have been grown or ground which was most highly manured; and I think it capable of demonstration, that high manuring will make farming pay here at the east, and that it is not possible to make it pay on our soil unless there is a liberal and judicious use of manures.

In conclusion, I will say that up to this time the strength of our efforts has been expended in clearing and draining our farm and in getting it in such condition as to raise medium crops. This work is now done, and our plan for the future is to do much more in experiments on crops, fertilizers, implements and stock. As far as present experience goes, it indicates that a mixed husbandry is the only safe one for a farmer to pursue, and that paying crops of our great staples, corn, wheat, rye and hay, can be grown on highly enriched and high priced land.

We are glad to show our experiments to those interested in the improvement of agriculture—to show our failures as well as our successes—and we invite farmers, committees, or societies to examine our work. I shall be about the farm on Wednesdays, and the Superintendent is always ready to wait upon visitors.

GEO. H. COOK.

Rutgers College, New Brunswick, N. J.,
November 25, 1873.

APPENDIX C.

COURSES OF STUDY.

Three distinct courses of study are included in the Schedule which follows:

I. A Course in Civil Engineering and Mechanics.

II. A Course in Chemistry and Agriculture.

III. A Special Course in Chemistry.

During the first and second years the studies of the two full courses are the same, and are designed to furnish a suitable introduction to the pursuit of the higher branches in either.

During the last two years the subjects of Higher Mathematics, Mechanics and Engineering in the Engineering course are replaced by Analytical Chemistry, practice in the Laboratory, and Agriculture in the other. The remaining subjects are pursued by the students of both courses together.

The course of study for the first two years in this Department is arranged so as to be complete in itself. It is especially designed to meet the wants of those who cannot take the entire four years' course, but who desire to fit themselves as Land Surveyors. Students leaving at this period of the course, receive from the Faculty a certificate of their attainments.

Special Students are received, and allowed to take any part of the above course; and particular provision is made for them, especially in the Laboratory, in Mathematics and Surveying.

The Special Course in Chemistry and Agriculture, occupying two years, is designed for those who wish to devote themselves exclusively to these branches. Opportunities of a very superior character are afforded to such students under the charge of Professors Cook, Smock and Van Dyck, in the new Labratory building.

SPECIAL PROVISION IS ALSO MADE FOR STUDENTS WHO DESIRE, AFTER COMPLETING THE REGULAR COURSE OE STUDY, TO TAKE POST-GRADUATE STUDIES.

COURSE OF STUDY.

FRESHMAN YEAR.

Exercises during the year in Composition and Declamation. Bible Class each Sabbath morning.

FIRST TERM.

1. French. 2. Mathematics—Loomis' Algebra, from Quadratic Equations. 3. Natural History—Dalton's Physiology; Lectures. 4. Rhetoric—Haven; Lectures. 5. Draughting—Construction of Problems.

SECOND TERM.

1. French. 2. Mathematics—Loomis' Geometry, from Book IV. 3. Natural History—Zoology; Lectures. 4. Elocution—Lectures. 5. English Literature—Shaw's Manual; Craik's English of Shakespeare. 6. Draughting.

THIRD TERM.

1. French. 2. Mathematics—Loomis' Trigonometry, Plane and Spherical. 3. Natural History—Gray's Botany; Lectures. 4. English Literature—Shaw's Manual; Lectures. 5. Draughting.

SOPHOMORE YEAR.

Exercises during the year in Composition and Declamation. Bible Class each Sabbath morning.

FIRST TERM.

1. Surveying—Murray's Manual; Field Exercises and Mapping. 2. Descriptive Geometry—Church. 3. Chemistry—Lectures. 4. Mental Philosophy—Haven. 5. History—Freeman's Outlines.

SECOND TERM.

1. Descriptive Geometry—Church; Construction of Problems. 2. Chemistry—Lectures. 3. Mental Philosophy—Haven. 4. History—Freeman's Outlines.

THIRD TERM.

1. Leveling and Railroad Curves—Henck's Field Book; Field Practice and Plotting. 2. Shades, Shadows and Perspective—Church; Construction of Problems. 3. Chemistry—Lectures. 4. Mental Philosophy—Lectures. 5. History—Creasy's Constitutional History of England.

JUNIOR YEAR.

COURSE IN CIVIL ENGINEERING AND MECHANICS.

Exercises during the year in Composition and Original Declamation. Bible Class each Sabbath morning.

FIRST TERM.

1. German. 2. Analytical Geometry—Peck. 3. Natural Philosophy--Snell's Olmsted. 4. History of Civilization--Guizot. 5. Constitutional History of the United States--Text book and Lectures. 6. Draughting.

SECOND TERM.

1. German. 2. Differential and Integral Calculus—Peck. 3. Natural Philosophy—Snell's Olmsted. 4. Political Economy—Bowen and Perry. 5. Constitutional History of the United States—Text book and Lectures. 6. Draughting.

THIRD TERM.

1. German. 2. Mechanics—Bartlett, or Smith. 3. Astronomy—Loomis. 4. International Law—Woolsey. 5. Draughting.

JUNIOR YEAR.

COURSE IN CHEMISTRY AND AGRICULTURE.

Exercises during the year in Composition and Original Declamation. Bible Class each Sabbath morning.

FIRST TERM.

1. German. 2. Mineralogy and Analytical Chemistry—Text book, with Labratory Practice. 3. Agriculture—Lectures at the Farm. 4. Natural Philosophy—Snell's Olmsted. 5. History of Civilization—Guizot. 6. Constitutional History of the United States—Text book and Lectures.

SECOND TERM.

1. German. 2. Analytical Chemistry—Text book, with Laboratory Practice. 3. Agriculture—Lectures. 4. Natural Philosophy—Snell's Olmsted. 5. Political Economy—Bowen and Perry. 6. Constitutional History of the United States—Text book and Lectures.

THIRD TERM.

1. German. 2. Analytical Chemistry—Text book, with Laboratory Practice. 3. Agriculture—Vegetable Physiology. 4. International Law—Woolsey.

SENIOR YEAR.

COURSE IN CIVIL ENGINEERING AND MECHANICS.

Exercises during the year in Composition and Original Declamation. Bible Class each Sabbath morning.

FIRST TERM.

1. Mechanics—Bartlett, or Smith. 2. Geodesy—Theory and

Practice of Triangulation. 3. Chemistry—Lectures on Organic Chemistry. 4. Moral Philosophy—Wayland and Hopkins.

SECOND TERM.

1. Engineering—Mahan. 2. Geodesy—Practical Astronomy; Indeterminate Analysis. 3. Chemistry—Lectures on Chemical Physics. 4. Moral Philosophy—Butler's Analogy.

THIRD TERM.

1. Engineering—Bridge-Building and Railway Practice. 2. Architecture—Lectures. 3. Geology—Lectures; Geological Excursion. 4. Moral Philosophy—Butler's Analogy.

SENIOR YEAR.

COURSE IN CHEMISTRY AND AGRICULTURE.

Exercises during the year in Composition and Original Declamation. Bible Class each Sabbath morning.

FIRST TERM.

1. Mining and Metallurgy. 2. Chemistry and Principles of Agriculture—Lectures. 3. Laboratory Practice. 4. Moral Philosophy—Wayland and Hopkins.

SECOND TERM.

1. Agriculture—Its Methods and Products. 2. Chemistry—Lectures on Chemical Physics. 3. Laboratory Practice. 4. Moral Philosophy—Butler's Analogy.

THIRD TERM.

1 Agriculture—Animal Physiology; Care and Management of Domestic Animals. 2. Architecture—Lectures. 3. Geology—Lectures; Geological Excursion. 4. Moral Philosophy—Butler's Analogy.

SPECIAL COURSE IN CHEMISTRY.

FIRST YEAR—FIRST TERM.

1. Elements of Chemistry—Text book and Lectures. 2. Blowpe Analysis. 3. Elements of Mineralogy.

SECOND TERM.

1. Physics and Chemistry—Text book and Lectures. 2. Chemical Analysis—Qualitative.

THIRD TERM.

1. Chemical Analysis—Qualitative and Quantitative. 2. Vegetable Physiology.

SECOND YEAR—FIRST TERM.

1. Chemical Analysis—Analysis of Minerals, Ores, &c. 2. Mineralogy—Determinative.

SECOND TERM.

1. Chemical Physics—Heat, Electricity, Magnetism, Galvanism and Electro-magnetism—Text book and Lectures. 2. Analysis of Fertilizers and Chemical Products.

THIRD TERM.

1. Lectures on Geology. 2. Chemical Analysis—Special Investigations.

APPENDIX D.

REPORT OF THE BOARD OF VISITORS.

To His Excellency, Joel Parker, Governor of the State of New Jersey :

The Board of Visitors of the New Jersey State College for Agriculture and Mechanic Arts, beg leave to present their ninth annual report as required by law :

Since our last report this board has held, in accordance with the provisions of the law under which it is organized, two semi-annual meetings at the College buildings at New Brunswick. They have also visited the College Farm. The first of these meetings was held December 17th, 1872. The second was held June the 13th, 1873. At these meetings they attended a portion of the examinations of the classes of the College in the subjects of study for the past terms, which was in the term preceding the December meeting, as follows :

SENIOR CLASS.

Subject.	Professor.	Per week.
Moral Philosophy,	President,	4 times.
Political Economy,	Prof. Atherton,	4 times.
Mechanics,	Prof. Bowser,	4 times.
Organic Chemistry,	Prof. Smock,	4 times.

SOPHOMORE CLASS.

Surveying,	Professor Bowser,	3 times.
Field practice in Surveying,	Tutor Cook,	3 times.
Descriptive Geometry,	Professor Bowser,	4 times.
History,	Professor Atherton,	3 times.
Inorganic Chemistry,	Professor VanDyke,	3 times.

FRESHMAN CLASS.

French,	Dr. Meyer,	3 times.
Algebra,	Tutor Cook,	5 times.
Physiology,	Professor Smock,	2 times.
Botany,	Professor VanDyke,	3 times.
Draughting,	Tutor Cook,	5 times.

The Board inspected the Laboratory in Geological Hall, now fitted up and in use for Analytical Chemistry, under Professor Van-Dyck.

The Deputy Secretary reported to the Board the names of those holding State Scholarships from the different counties. A majority of the counties in the State were represented. On motion it was resolved that the present condition of the Institution, as evinced by the examinations of the classes and by the reports of the President and Faculty is highly satisfactory, and that the hearty commendation of this Board is due and is hereby tendered to the Trustees and Faculty of Rutgers College for their liberal and wise conduct of the affairs of the State College for Agriculture and the Mechanic Arts.

Dr. Cook, Professor of Agriculture, reported that he had nearly completed his task of delivering lectures upon Agriculture in each county, and that the requirements of the law in that respect will have been complied with before the close of the year.

At the meeting of the Board held June 13th, 1873, at the College edifice, the following named members of the Board were present:

First District, Hon. Chalkley Albertson.
Second District, Hon. William Parry.
Third District, Hon. William A. Newell.
Third District, Henry K. How, Esq.
Fourth District, William R. Janeway, Esq.
Fourth District, Hon. Joseph Thompson.
Fifth District, Rev. John Steele, D. D.
Sixth District, Hon. William M. Force.
Seventh District, Hon. Abraham S. Duryea.

Committees of the Board attended the examinations of several of the classes in different branches of study. After the examinations the Board met in President Campbell's room, and organized by appointing Hon. William Parry, as President, and Henry K. How, as Secretary.

Professor Cook made a statement of the number and condition of agricultural colleges in this country. President Campbell spoke of the progress and prospects of the New Jersey State College for Agriculture and Mechanic Arts. The subjects of study for the term preceding this meeting had been as follows:

SENIOR CLASS—COURSE IN CHEMISTRY AND AGRICULTURE.

Animal Physiology, and care and management of Domestic Animals, Chemistry.

Architecture—Lectures. Geology—Lectures and Geological Excursion. Moral Philosophy—Butler's Analogy.

COURSE IN CIVIL ENGINEERING AND MECHANICS.

Engineering (Bridge Building and Railway Practice), and Chemistry. Architecture—Lectures.

Geology—Lectures and Geological Excursion. Moral Philosophy—Butler's Analogy.

JUNIOR CLASS—COURSE IN CIVIL ENGINEERING AND MECHANICS.

German. Mechanics—Bartlett & Smith. Astronomy—Lockyer's Astronomy. International Law—Woolsey. Draughting.

COURSE IN CHEMISTRY AND AGRICULTURE.

German. Analytical Chemistry with Laboratory Practice. Agriculture—Vegetable Physiology. International Law—Woolsey.

SOPHOMORE CLASS.

Leveling and Railway Curves—Henck's Field Book. Field Practice and Plotting.

Shades, Shadows and Perspective—Church. Construction of Problems.

Chemistry—Lectures. History—Creasy's Constitutional History of England.

Mental Philosophy—Lectures.

FRESHMAN CLASS.

French. Mathematics—Trigonometry, Plane and Spherical. Natural History. Botany—Grey. Lectures—English Literature, Shaw's Manual and Lectures. Draughting.

All of the classes have had exercises during the year in Composition and Declamation. The Seniors and Juniors in Original Declamation. All the classes have attended the Bible Class each Sabbath morning.

The Board in the afternoon of June 13th, heard the reading of Theses by the Graduating Class. They were read in the following order:

1. Oswald Haldane, of Cold Spring, N. Y., Subject, "The Manufactures of Iron."
2. James Thomas Lillis, of Hudson City, N. J., "The Improvements adopted in the Water Works, of Jersey City."
3. Henry Augustus Neilson, of New Brunswick, N. J., "Clay."
4. Myron Chauncey Peck, of Albany, N. Y., "The New Capitol Building of the State, at Albany."
5. Clarence Peters, of Newark, N. J., "Zinc and its Manufactures."

6. William P. Stephens, of Rahway, N. J., "Light Bridges."

7. Charles F. Stillman, of Plainfield, N. J., "The Adulteration of Medicines."

8 Thomas Bliss Stillman, of Plainfield, N. J., "The Ashes of Plants."

9. Charles T. Van Santvord, of New York City, "The Compound Steam Engine."

10. Elbridge Van Syckel, Jr., of Bound Brook, N. J., "Pettit's Stiffened Triangular Truss."

11. Herbert Fuller Watson, of Clayton, N. J., "The Truss used in constructing the Railroad Bridge at Hightstown, N. J."

12. William Williamson, of New Brunswick, N. J., "Description of a proposed bridge of Stone and Iron for crossing the Raritan river at New Brunswick."

The first prize was awarded to Elbridge Van Syckel, Jr.,; the second, to Thomas Bliss Stillman.

These prizes were given after a careful examination of the manuscripts, by a committee composed of three members of the Faculty.

The first prize consists of books valued at fifteen dollars; the second prize of books to the value of ten dollars. All of the Theses were good, and several were deserving of high commendation.

By a unanimous vote of the Board the Secretary was instructed to enter on the minutes a statement of the entire satisfaction of the Board of Visitors at what they had seen and heard during their visit to the New Jersey State College for Agriculture and the Mechanic Arts.

The Board adjourned to meet at the College Farm upon such a day as should be selected by the State Board of Agriculture to meet at the same place. The first day of July being the time appointed by the State Board of Agriculture, several of the Board of Visitors met with them at the College Farm. After the tour of inspection they proceeded to the Geological Hall and held a very profitable and interesting and instructive meeting.

Professor Cook gave an account of the various fertilizers employed in experiments on the farm. He exhibited specimens and analyses of them and a series of computations as to real value compared with their selling prices. He also explained the mode of computation.

The general appearance of the farm the condition of the crops and the trial of experiments showed skillful care, successful effort and useful results.

All of which is respectfully submitted.

WILLIAM PARRY, *President.*

HENRY K. HOW, *Secretary.*

NEW JERSEY STATE AGRICULTURAL COLLEGE.

INFORMATION RELATING TO ITS ESTABLISHMENT, INSTRUCTION IN IT, &C.

An Act donating public lands to the several States and Territories which may provide colleges for the benefit of agriculture and the mechanic arts.

1. BE IT ENACTED *by the Senate and House of Representatives of the United States of America in Congress assembled*, That there be granted to the several States, for the purposes hereinafter mentioned, an amount of public land, to be apportioned to each State, a quantity equal to thirty thousand acres for each Senator and Representative in Congress to which the States are respectively entitled by the apportionment under the census of eighteen hundred and sixty; *provided*, that no mineral lands shall be selected or purchased under the provisions of this act.

SEC. 2. *And be it further enacted*, That the land aforesaid, after being surveyed, shall be apportioned to the several States in sections or subdivisions of sections, not less than one-quarter of a section; and whenever there are public lands in a State subject to sale at private entry at one dollar and twenty-five cents per acre, the quantity to which said State shall be entitled shall be selected from such lands within the limits of such State, and the Secretary of the Interior is hereby directed to issue to each of the States in which there is not the quantity of public lands subject to sale at private entry at one dollar and twenty-five cents per acre, to which said State may be entitled under the provisions of this act, land scrip to the amount in acres for the deficiency of its distributive share; said scrip to be sold by said States and the proceeds thereof applied to the uses and purposes prescribed in this act, and for no other use or purpose whatsoever; *provided*, that in no case shall any State to which land scrip may thus be issued be allowed to locate the same within the limits of any other State, or of any Territory of the United States, but their assignees may thus locate said land scrip upon any of the unappropriated lands of the United States subject to sale at private entry at one dollar and twenty-five cents, or less, per acre; *and provided fur-*

ther, that not more than one million acres shall be located by such assignees in any one of the States; *and provided further*, that no such location shall be made before one year from the passage of this act.

SEC. 3. *And be it further enacted*, That all the expenses of management, superintendence, and taxes from date of selection of said lands, previous to their sales, and all expenses incurred in the management and disbursement of the moneys which may be received therefrom, shall be paid by the States to which they may belong, out of the treasury of said States, so that the entire proceeds of the sale of said lands shall be applied without any diminution whatever to the purposes hereinafter mentioned.

SEC. 4. *And be it further enacted*, That all moneys derived from the sale of the lands aforesaid by the States to which the lands are apportioned, and from the sales of land scrip hereinbefore provided for, shall be invested in stocks of the United States, or of the States, or some other safe stocks, yielding not less than five per centum upon the par value of said stocks; and that the moneys so invested shall constitute a perpetual fund, the capital of which shall remain forever undiminished, (except so far as may be provided in section fifth of this act), and the interest of which shall be inviolably appropriated, by each State which may take and claim the benefit of this act, to the endowment, support, and maintenance of at least one college where the leading object shall be, without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the Legislatures of the States may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in several pursuits and professions in life.

SEC. 5. *And be it further enacted*, That the grant of land and land scrip hereby authorized shall be made on the following conditions, to which, as well as to the provisions hereinbefore contained, the previous assent of the several States shall be signified by legislative acts:

First. If any portion of the fund invested, as provided by the foregoing section, or any portion of the interest thereon, shall, by any action or contingency, be diminished or lost, it shall be replaced by the State to which it belongs, so that the capital of the fund shall remain forever undiminished; and the annual interest shall be regularly applied without diminution to the purposes mentioned in the fourth section of this act, except that a sum, not exceeding ten per centum upon the amount received by any State under the provisions of this act, may be expended for the purchase of lands for sites or experimental farms, whenever authorized by the respective legislatures of said States.

Second. No portion of said fund, nor the interest thereon, shall be applied, directly or indirectly, under any pretence whatever, to the purchase, erection, preservation or repair of any building or buildings.

Third. Any State which may take and claim the benefit of the provisions of this act, shall provide, within five years, at least not less than one college, as described in the fourth section of this act, or the grant to such State shall cease; and said State shall be bound to pay the United States the amount received of any lands previously sold, and that the title to purchasers under the State shall be valid.

Fourth. An annual report shall be made regarding the progress of each college, recording any improvements and experiments made, with their costs and results, and such other matters, including State industrial and economical statistics, as may be supposed useful, one copy of which shall be transmitted by mail free, by each, to all the other colleges which may be endowed under the provisions of this act, and also one copy to the Secretary of the Interior.

Fifth. When lands shall be selected from those which have been raised to double the minimum in price, in consequence of railroad grants, they shall be computed to the States at the maximum price, and the number of acres proportionally diminished.

Sixth. No State, while in a condition of rebellion or insurrection against the government of the United States, shall be entitled to the benefit of this act.

Seventh. No State shall be entitled to the benefits of this act unless it shall express its acceptance thereof by its legislature within two years from the date of its approval by the President.

SEC. 6. *And be it further enacted*, That land scrip issued under the provisions of this act shall not be subject to location until after the first day of January, one thousand eight hundred and sixty-three.

SEC. 7. *And be it further enacted*, That the land officers shall receive the same fees for locating land scrip issued under the provisions of this act as is now allowed for the location of military bounty land warrants under existing laws; *provided*, their maximum compensation shall not be thereby increased.

SEC. 8. *And be it further enacted*, That the Governors of the several States to which scrip shall be issued under this act, shall be required to report annually to Congress all sales made of such scrip until the whole shall be disposed of, the amount received for the same, and what appropriation has been made of the proceeds.

Approved July 2, 1862.

An Act accepting on the part of the State of New Jersey a grant of lands made by the United States to the several States and Territories which may provide Colleges for the benefit of the Agricultural and the Mechanic Arts.

1. BE IT ENACTED *by the Senate and General Assembly of the State of New Jersey*, That an act of Congress of the United States, approved July fifteenth, A. D. eighteen hundred and fifty-two, entitled "An act donating public lands to the several States and Territories which may provide Colleges for the benefit of Agriculture and the Mechanic Arts," and the grant of land and land scrip thereby made, be and the same is hereby accepted on the part of the State of New Jersey.

2. *And be it enacted*, That the said grant of land and land scrip is hereby accepted for the purposes and upon the conditions in said act of Congress specified, and the assent of the State of New Jersey to the several conditions and provisions in said act contained, is hereby signified and expressed.

3. *And be it enacted*, That the Governor of this State, and such persons as he shall appoint for that purpose, are hereby appointed commissioners to receive from the Secretary of the Interior, or other officer of the United States, the land scrip to which the State of New Jersey is or may be entitled under the act of Congress aforesaid, said scrip to be held by said commissioners for the State, until provision is made by law for the sale thereof and investment of the proceeds in accordance with the provisions of said act of Congress.

4. *And be it enacted*, That this act shall take effect immediately.

Approved March 21, 1863.

An act appropriating scrip for the public lands granted to the State of New Jersey by the act of Congress, approved July second, one thousand eight hundred and sixty-two.

WHEREAS, the governor of this State has received from the secretary of the interior the scrip for public lands granted to the State of New Jersey by an act of congress of the United States, approved July second, one thousand eight hundred and sixty-two, and holds the same subject to such disposition as may be made by the legislature; therefore,

1. BE IT ENACTED *by the Senate and General Assembly of the State of New Jersey*, That the governor of this state, the attorney

general, the secretary of state, the comptroller, in case such office be created, and the treasurer of the state, and their successors in office for the time being, be and they are hereby appointed commissioners to take charge of such scrip, and, as agents of the State, to sell and dispose of the same at such time or times, and in such mode as may appear to be most advantageous and safe; and in the name and on behalf of this State to convey and transfer the same to the purchaser or purchasers thereof, and to invest the avails thereof in the manner specially provided by said act of congress.

2. *And be it enacted*, That said commissioners shall semi-annually pay over the interest of the fund which may result from the sale of said scrip, to the trustees of Rutgers College, in New Jersey, for the special purposes and upon the special conditions hereinafter set forth.

3. *And be it enacted*, That said trustees shall devote said interest wholly and exclusively to the maintenance, in that department of Rutgers College, known as Rutgers Scientific School, of such courses of instruction as (including the courses of instruction already established by said trustees,) shall carry out the intent of said act of congress in the manner specially prescribed by the fourth section of said act.

4. *And be it enacted*, That said trustees shall furnish gratuitous education in said courses of instruction to pupils of said school in such manner as the legislature shall prescribe, the number of pupils to be so received gratuitously into said school, shall be in each year such a number as would expend a sum equal to one-half of the said interest for the same year, in paying for their instruction in said school, if they were required to pay for it at the regular rates charged to other pupils of said school, for the same year; said pupils so nominated and received shall be citizens of this State, and shall be admitted into said school upon the same terms, and subject to the same rules and discipline which shall apply to all other pupils of said school, with the single exception that they shall not be required to pay anything for their instruction.

5. *And be it enacted*, That said trustees shall annually make and distribute the reports required by the fourth paragraph of section fifth of said act of congress.

6. *And be it enacted*, That no portion of the said interest shall be paid over to said trustees until they shall contract with this State, in such form as the said commissioners shall approve, to fulfill and perform all the duties and obligations imposed upon them by this act; *provided*, that the said board of trustees shall, in their corporate capacity, obligate themselves to erect additional and adequate buildings, as soon as the same may become necessary, without charge to or upon this State, and in like manner, to furnish and provide a suitable tract of land conveniently located, for an experimental farm.

7. *And be it enacted*, That there shall be appointed by the gov

ernor, with the advice and consent of the senate, a board of visitors, consisting of ten persons, two from each congressional district in this State, who shall hold their office respectively for five years, and who shall in the first instance be so appointed that the term of office of two of the said board of visitors shall expire each year, and the governor shall in like manner appoint two, annually thereafter, and shall have power to fill all vacancies in the board; but the person so appointed to fill such vacancy shall only serve under such appointment until the next meeting of the senate, and until an appointment shall have been made by the governor, with the advice and consent of the senate, and the person so appointed shall hold such office only for the unexpired term of the person whose place he is to supply, and it shall be the duty of the board of visitors to visit the said school at least twice in each year, and to make report thereon to the legislature during the second week of the annual session.

8. *And be it enacted*, That the board of visitors shall possess general powers of supervision and control, and shall report to the legislature such recommendations as to them may seem proper.

9. *And be it enacted*, That the said board of trustees shall cause to be delivered annually in each county of this State, one or more public lectures upon the subject of agriculture, free of charge.

10. *And be it enacted*, That the students of agriculture and the mechanic arts, shall be admitted into said college, upon the recommendation of the board of chosen freeholders of their respective counties, and the number of students that a county shall at any one time be entitled to have in said college shall be equal to the number of representatives in the legislature to which such county is entitled, or in proportion to the same.

11. *And be it enacted*, That the legislature shall have power at any time hereafter, to pass such laws as may be deemed necessary and proper to enforce the due execution of this act, and of the before mentioned act of congress.

12. *And be it enacted*, That this act shall take effect immediately.

Approved April 4, 1864.

An Act to provide for Commissioners of the Agricultural College Fund, in pursuance of the provisions of the act of Congress, passed July second, eighteen hundred and sixty-two, entitled "An act donating public lands to the several states and territories which may provide colleges for the benefit of agriculture and the mechanic arts."

1. BE IT ENACTED, *by the Senate and General Assembly of the State of New Jersey*, That the governor of the state, the state treasurer, the attorney general, the secretary of state and comptroller, in case said office be created, shall be commissioners for the sale of the land scrip donated to this State by the United States, by virtue of the act of congress hereinbefore referred to, and for the investment of the proceeds of such sale, who shall be known as "The Commissioners of the Agricultural College Fund;" they shall have power, and it shall be their duty to sell and assign said scrip or portions of it from time to time, as it may seem best for the interests of the State, until the whole of said scrip is sold, and an assignment endorsed on the back of a piece of land scrip, signed by said commissioners shall pass and convey to the purchaser or purchasers thereof, all the right and title and interest that the State of New Jersey shall have in the same at the time of such assignment; the commissioners shall have power, and it shall be their duty to invest the money received from such sales, in accordance with the act of congress hereinbefore referred to; they shall have power to change said investments, and to re-invest such portions as may at any time be paid off, and it shall be their duty, so far as possible, to keep said fund and every portion of it, in a productive condition; the bonds and other securities belonging to said fund shall be in the keeping of the State treasurer, who shall be, ex-officio, treasurer of the commissioners; the treasurer shall keep the accounts of this fund separate and distinct from all other accounts; the commissioners shall make annually to the legislature a detailed report of their doings under this act and of the state of said fund.

2. *And be it enacted*, That the expenses necessarily incurred by the commissioners, in the discharge of their duties, shall be defrayed out of the treasury of the State, upon the warrant of the governor, said expenses, however, not to exceed two hundred and fifty dollars per annum, unless by virtue of a special appropriation for that purpose; and the commissioners shall receive no compensation for their services.

3. *And be it enacted*, That this act shall take effect immediately.

Approved April 13, 1864.

An Act providing for the appointment of State Students to the Agricultural Colleges.

1. Be it enacted *by the Senate and General Assembly of the State of New Jersey*, That it shall be the duty of the State superintendent of public schools to serve notice upon the board of chosen freeholders in each of the counties of this State, at their annual meetings, requesting the appointment of a board of examiners in accordance with the eighth section of "An act to establish Public Schools," approved April seventeenth, eighteen hundred and forty-six, and if the boards of freeholders of any county neglect or refuse to appoint examiners as aforesaid, then it shall be the duty of the State superintendent to appoint two or more discreet persons who shall constitute a board of examiners in and for said county, and who shall hold office until the next annual meeting of the board of freeholders for said county.

2. *And be it enacted*, That it shall be the duty of the boards of examiners of the several counties, in addition to the duties defined in the "Act to establish Public Schools," as aforesaid, to meet on the second Thursday of August of each year; *provided*, the State superintendent so appoints, and proceed to examine such candidates for State scholarships at the agricultural college as may present themselves, and the candidates shall be subjected to such examination as the faculty of the said college and State superintendent shall prescribe; and the candidates who shall receive certificates of appointment to the agricultural college in any one county, shall be those who obtain the highest average number respecting scholarship; and the number of certificates thus granted shall in no case exceed the number of State scholarships to which such county is entitled.

3. *And be it enacted*, That this act shall take effect immediately; all acts or parts of acts inconsistent with this act being hereby repealed.

Approved March 28, 1866.

Sec. 27 of "An act to establish a system of Public Instruction."

27. *And be it enacted*, That it shall be the duty of the county superintendent, at such time and place as the State superintendent may appoint, to examine such candidates for State scholarships at the agricultural college, as may present themselves, and the candidates shall be subjected to such examination as the faculty of the said college and the State superintendent shall prescribe; and the candi-

dates who shall receive certificates of appointment to the agricultural college in any one county, shall be those who obtain on such examination the highest average for scholarship ; and the number of certificates thus granted, shall in no case exceed the number of State scholarships to which such county is entitled.

Supplement to the act entitled, " An Act appropriating Scrip for the Public Lands granted to the State of New Jersey by the act of Congress," approved July second, one thousand eight hundred and sixty-two.

1. Be it enacted *by the Senate and General Assembly of the State of New Jersey*, That the public lectures hereafter to be delivered by the State agricultural college in the counties of this State, shall, as to number, time and place, be under the direction of the board of visitors of the State agricultural college.

2. *And be it enacted*, That this act shall take effect immediately.

Approved February 27, 1873.

CONTENTS.

1. State Board of Visitors..Page 3
2. Report of the Board of Trustees.. " 5
3. Annual Lecture—Appendix A.. " 13
4. Report of the College Farm—Appendix B........................ " 31
5. Courses of Study—Appendix C.. " 39
6. Report of the Board of Visitors—Appendix D.................. " 45
7. Act of Congress, approved July 2, 1862............................ " 49
8. Act of New Jersey Legislature, approved March 21, 1863...... " 52
9. Act of New Jersey Legislature, approved April 4, 1864.......... " 52
10. Act of New Jersey Legislature, approved April 13, 1864......... " 55
11. Act of New Jersey Legislature, approved March 28, 1866....... " 56
12. Section twenty-seven of "An act to establish a System of Public Instruction," approved March 21, 1867...................... " 57
13. Act of New Jersey Legislature, approved February 27, 1874... " 57

ERRATA.

On page 19, lines 16 and 17 from the bottom, for "one-third," read ONE TO THREE. On page 27, line 14 from the bottom, for "one-fourth," read ONE AND ONE-FOURTH.

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